

**UTILISING 3D GAME ENGINE
TO DEVELOPING A REAL-WORLD
WALKTHROUGH-VIRTUAL REALITY
APPLICATION**

A thesis submitted to the Graduate School in
full fulfillment of the requirements for the degree
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by
Mohd.Fairuz bin Shiratuddin



**Sekolah Siswazah
(Graduate School)
Universiti Utara Malaysia**

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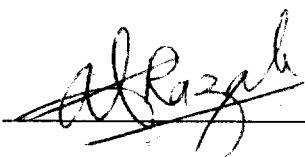
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ABSTRAK

Penyelidikan ini memperkenalkan suatu teknik menggunakan teknologi Enjin 3D yang wujud di dalam permainan komputer bagi membangunkan aplikasi realiti maya *Walkthrough*. Enjin 3D yang digunakan adalah daripada permainan komputer yang dikategorikan di dalam kumpulan *First Person Shooter (FPS) computer game*. Sebuah aplikasi prototaip realiti maya yang bermodelkan Masjid Sultan Badlishah di Universiti Utara Malaysia telah dibangunkan dengan menggunakan teknik ini. Ini menunjukkan elemen-elemen di dalam permainan komputer boleh digunakan untuk tujuan yang lebih serius dan selain bukan untuk hiburan semata-mata.

Teknik penggunaan enjin ini juga menjadi alternatif yang lebih baik daripada teknik realiti maya yang lazimnya digunakan iaitu *Virtual Reality Modelling Language* and *Panoramic View* yang masing-masing mempunyai kekangan tersendiri.

Empat metodologi telah digunapakai iaitu mengenalpasti enjin sesuai, membezakan ciri yang wujud di dalam *FPS Game* dan aplikasi *Walkthrough*, mengenalpasti ciri-istimewa yang terdapat di dalam *FPS Game* yang boleh dimasukkan ke dalam aplikasi bermodelkan Masjid Sultan Badlishah dan seterusnya pembangunan prototaip *Walkthrough* dengan berpandukan kepada metod yang telah dicapai sebelumnya.

Metodologi yang digunapakai telah berjaya membangunkan sebuah prototaip realiti maya yang mengeksplorasi teknologi Enjin Permainan Komputer 3D. Penggunaan teknologi ini memberikan paparan yang lebih realistik dan visual yang berkualiti yang hanya dibangunkan oleh komputer peribadi pada kos yang rendah di samping memberikan kualiti paparan yang canggih.

ABSTRACT

The research introduces methods of utilising 3D Game Engine that prevails in the First Person Shooter computer game into developing a usable real-world Walkthrough-VR application. The prototype is targeted at the lower-end of the computer consumer market whereby its operator are normally the home/office and desktop PC users.

This technique is proposed as a solution to the limitation of the widely used low cost VR technologies namely Virtual Reality Modelling Language (VRML) and 360° Panoramic View (based on Apple QuickTime VR).

In achieving the main objectives, four methods were employed. The first was to find a suitable 3D Game Engine to developing the prototype application. The second was to find distinctive characteristics differences that are present in both FPS Game and Walkthrough-VR application. The third was to determine the added advantages that are present in the FPS Game that can be incorporated into and enhance the Walkthrough-VR application. Finally findings from the three methods were used a guide to develop the prototype.

From the successfully developed prototype, it was concluded that by utilising the 3D Game. Engine technology the Walkthrough-VR experience was enhanced in terms of real-time realistic representation and good visual quality. It was proven that a good VR application could be developed using a lower cost desktop computer system where the users have the freedom to explore a visually engaging virtual environment with minimal PC requirement.

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LIST OF ABBREVIATIONS

CVE	Collaborative Virtual Environment
FPS	First Person Shooter
fps	Frames per Second
QTVR	QuickTime Virtual Reality
VE	Virtual Environment
VR	Virtual Reality
VRML	Virtual Reality Modelling Language
WoW	Windows on World

CHAPTER 1

INTRODUCTION TO THE RESEARCH

In the last few years, our dependency on computers has increased tremendously. The rapid development of faster microprocessor has resulted not only faster central processing units (CPU) but also faster and better graphics boards to be equipped in the computers. Hence computer graphics nowadays have been used in many forms of our lives. By the turn of the 21st century it is hard to contemplate architects, interior designers, engineers and even surgeons working without the assistance of graphics workstations. It is now possible even for the average home-user to shift into the world of computer graphics or popularly known as virtual reality. This new virtual world often make a start in the computer games domain and from there onwards it usually lasts forever (Mazuryk, 1996).

Yim (1995) defined computer games as “all types of games that can be played on an electronic device; this device can be a console machine, a coin-operated machine or a personal computer”.

Computer games have become one of most popular types of entertainment for young adults. The new generation of Americans regard computers games as part of their culture, educational and social acquaintance. The total revenue for the year 1998 alone amounted to 6.3 billion in the USA (Beckham, 1999). 90% of their households have either rented or owned a computer game (Quittner, 1999) with an average time spend of 20 minutes spent per day for playing computer games (Jensen, 1999).

Yim (1995) categorised computer games into 7 types. They are:

1. Action / Arcade
2. Strategy / War games
3. Simulation
4. Role Play Game (RPG)
5. Adventure
6. Sports
7. Educational

All computer games have engines and basically are the backbone of the games. Games that include 3D environment have 3D Game Engines behind them to take the description of 3D levels or virtual worlds. The uttermost goal of a 3D Game Engine is to generate photo-realistic images in real-time and display it on the computer monitor (Tyberghein, 1998).

The research introduces methods of utilising and applying 3D Game Engine technology, into developing a low cost but high performance Walkthrough-VR application. The 3D Game Engine used is present in the Action games' sub-category that is known as the First Person Shooter (FPS) game.

The current widely used VR technologies which are Virtual Reality Modelling Language (VRML) and QuickTime VR (QTVR) are either slow in simulating real-life walking movement or it is just simply not interactive enough. Wright (2000) describes VRML as slow in performance, awkward user interfaces (See Figure 1.2), and mediocre graphics. VRML graphics cannot come close to the quality of the current FPS games that are already available. QTVR displays real panoramic pictures however it presents very limited movement and interactivity.

It is hoped by the end of the research, Walkthrough-VR application can be applied in many areas. The methods described in the research will encourage the use of 3D Game Engine as a tool to developing real-world Walkthrough-VR application.

1.1 OBJECTIVES

- 1) To utilise the FPS 3D Game Engine technology that prevails in the entertainment sector into developing usable real world Walkthrough-VR application.
- 2) To determine the appropriate FPS 3D Game Engine to be used in the research
- 3) To study the major differences between FPS 3D Game and a Walkthrough-VR application
- 4) To determine the features of the FPS Game that can be included into the prototype Walkthrough-VR application
- 5) To introduce an alternative VR technology other than the popularly known VRML and Panoramic View
- 6) To reconstruct an approximate 3D Model using the 3D Game Engine based on a specific building

1.2 PROBLEM STATEMENT

The VR technology has not been widely geared towards industrial and social sectors. The major hindrance is the requirement of high cost equipment. Smith (1999) reported that in the 1960's only the American Military was able to use the highly cost and sophisticated virtual simulator for their military training purposes. In contrast, nowadays, VR is widely used in the entertainment industries. As such, they produce products that mimic the military technologies, as seen in virtual rides and simulators.

The low cost and high performance aspects were not the focus of the research but their definition would help synthesize the focus of this research. Shiratuddin *et al* (2000:3) defines 'low cost' as affordable by the home user, which refers to a present

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the thesis is for
internal user
only

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